Visitation of Hymenopterans to Seasonal Honeydew Produced by Crape Myrtle Bark Scale (Hemiptera: Eriococcidae)

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Crape myrtle bark scale (CMBS) is an exotic scale insect first detected in the United States 17 years ago (Gu et al., 2014) and infests crape myrtle trees, one of the most dominant trees in southern landscapes. Infestations result in high amounts of honeydew (their protein and sugar-rich excrement), reduced flowering, aesthetic loss, and in extreme cases, death to the tree. Over time, honeydew promotes the growth of sooty mold fungi, which produce darkened leaves, branches, and trunks. Honeydew is also an important carbohydrate resource for bees and wasps (Order: Hymenoptera) and is a preferred sugar resource for some species of parasitoid wasps (Lenaerts et al., 2014). Previous literature has shown that unmetabolized systemic insecticides can translocate through phloem-feeding pest insects and into the environment via honeydew at levels toxic to non-target insects (Calvo-Agudo et al., 2019; Quesada et al., 2020). However, previous studies have not evaluated whether production of honeydew and utilization of honeydew by other insects is seasonally variable. This study seeks to determine seasonal changes in honeydew production by CMBS and visitation by species of wasps and bees to infested crape myrtle trees to help with understanding the risks of systemic insecticide usage for non-target insects.

To quantify seasonal honeydew production, paper plates (Chinet©) lined with plastic wrap were wired to a PVC pipe staked into the ground underneath four infested landscape crape myrtles for 48 hours. The plates were returned to the lab, acetone washed into a centrifuge tube, and dried under a nitrogen blanket. Dry mass for each monthly sample of honeydew was recorded. To evaluate how honeydew may alter hymenopteran visitation to infested trees, pairs of infested and un-infested potted crape myrtles (n=20), 1.8 to 2.2 m tall, were placed at two sites with 3 m between the paired trees, and 15 m between each replicate. Trees were placed on each site 48 hours before data were collected to allow insects time to discover the trees. The number of hymenopteran insect visiting trees were determined by two observers (one per tree) at times 0600, 0900, 1200, and 1500 for two consecutive days. Observers would watch a tree for 5 min and then record the types and numbers of insects observed. Hymenopterans were included in the data if they landed on the tree within the 5-min observation period. Representative insects were captured during these observations and brought to the lab to confirm their identifications.

Our results show that the presence of CMBS and the associated honeydew can change the community diversity of bees and wasps (Figure 1). Of the hymenopterans collected, all species were beneficial insects, i.e., species that provide important ecological and economic services such as pollination and pest control. Most were yellow jackets, paper wasps, and wasps that predate or parasitize other insects, and a few were bees. The wasps collected were not natural enemies of CMBS, so we assumed most were attracted to the honeydew and not directly to the scale insects. Significant differences in hymenopteran visitation were observed during the months of June, July, and September, hot and dry months when nectar and other sugar sources are limited. Additionally, we observed significant differences in seasonal production of honeydew in October, with an average recorded mass three times greater than average masses during the previous months combined (Figure 1).

The results of our experiment add to existing literature of honeydew utilization by other insect species. Trees infested with CMBS will attract beneficial wasps and bees. If an infested tree is treated with systemic insecticides, the insecticide residue may pass into the honeydew and inadvertently expose beneficial insects. Our experiments show high honeydew production but virtually no wasps or bees on trees in October. This may

provide an opportune time to treat infested trees while reducing the risk of exposure to non-target insects.

Statement of Research Advisor

Elijah Carroll conducted experiments to determine when honeydew is produced by CMBS and how that may influence beneficial insects using that resource. Honeydew, the sugary excrement of sap-sucking insects, has been reported for many years as useful carbohydrate sources for other insects. More recently, honeydew was identified as a possible route of exposure for non-target insects. This work helps us to understand how systemic insecticides, widely used to manage CMBS, may be delivered to beneficial insects and even natural enemies of CMBS. Elijah took ownership of this project and demonstrated the ability to mobilize a research team as well as work independently.
-David Held, Entomology and Plant Pathology

References

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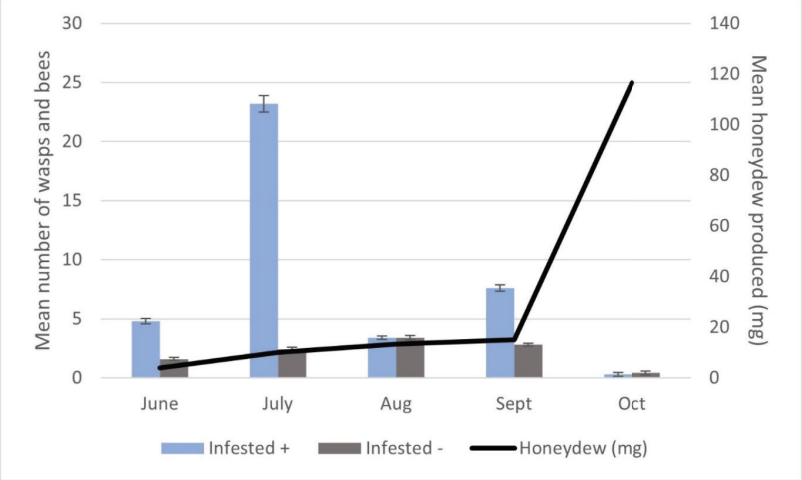

Figure 1. Seasonal visitation of *hymentopterans* (bar) and the seasonal mass of collected honeydew (line).